

IN-DEPTH STUDIES ON HEALTH AND ENVIRONMENTAL IMPACTS OF  
SELECTED WATER POLLUTANTS

Nov 1, 1977

MONTHLY REPORTS

EPA CONTRACT NO: 68-01-4646

TASK II

SUBMITTED TO:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
CRITERIA BRANCH  
WASHINGTON, D.C.

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## TASK II

### Static Acute Bioassays and Physical Chemistry Measurements

#### Static Acute Bioassays

Static, acute toxicity tests were conducted with freshwater and saltwater species including:

Freshwater species:

Selenastrum capricornutum - green alga

Daphnia magna - water flea

Lepomis macrochirus - bluegill sunfish

Saltwater species:

Skeletonema costatum - diatom

Mysidopsis bahia - mysid shrimp

Cyprinodon variegatus - sheepshead minnow

according to procedures in "Methods for acute toxicity tests with fish, macroinvertebrates and amphibians" (U.S. EPA, 1975 Ecological Research Series EPA-600/3-75-009: 61 pp). Definitive test concentrations were selected on the basis of preliminary range finding tests and were in a range which would permit an evaluation of the exposure concentration - response relations such that a time dependent median effective concentration (EC-50) for algae or median lethal concentration (LC50) for macroinvertebrates and fish was calculated. The criterion for effect in algal tests was percentage decrease of in vivo chlorophyll a concentrations exposed cultures relative to controls and percentage decrease in cell numbers of exposed versus control cultures. In macroinvertebrates

and fish tests, the criterion for effect was death.

Results of bioassays completed in December are presented in Tables 1-5. Raw data tables and graphical displays of these data are presented in Appendix I.

The status of Task II through 31 December 1977 is as follows:

<u>Organisms</u>	<u>Total number of bioassays to be performed in this task</u>	<u>Bioassays completed</u>	<u>%</u>	<u>% of to</u>
1. Freshwater				
a. Alga	40	21	52	
b. Invertebrate	66	53	80	
c. Fish	60	48	80	
2. Marine				
a. Alga	40	19	48	
b. Invertebrate	41	27	66	
c. Fish	41	27	66	
Totals	288	195	68	

Table 6 indicates the static acute toxicity tests completed through 31 December 1977.

Attached is an updated schedule of the completion dates for the remaining tests.

Man hours expended in this task through 31 December 1977 were 8,289.

Costs through 31 December 1977 associated with the performance of this task were \$130,434 and 68% of this task has been completed.

\$289,600

TASK II - RESULTS OF STATIC ACUTE TOXICITY TESTS

1. Bluegill sunfish (Lepomis macrochirus)

Compound	LC50 (95% confidence limits) ppm				No effect conc. at 96-hour (ppm)
	24-hour	48-hour	72-hour	96-hour	
1,2,3,5-tetrachlorobenzene	57.8 (50.1-65.1)	11.5 (8.35-17.4)	8.34 (6.48-10.2)	6.42 (5.19-8.09)	<1.70
1,1,2-trichloroethane	40.2 (34.8-47.2)	40.2 (34.8-47.2)	40.2 (34.8-47.2)	40.2 (34.8-47.2)	<22.0
bis-2-chloroethyl ether	>600	>600	>600	>600	<220
2,3,5,6-tetrachlorophenol	0.40 (0.33-0.51)	0.20 (0.16-0.24)	0.17 (0.13-0.21)	0.17 (0.13-0.21)	<0.05
4-chloro-6-methylphenol	3.83 (3.13-4.76)	3.83 (3.13-4.76)	2.80 (2.15-3.40)	2.33 (1.90-2.90)	<0.6
1,3-dichloropropene	6.84 (6.13-7.63)	6.71 (5.87-7.60)	6.45 (5.59-7.28)	6.06 (5.14-6.82)	3.60
2,3-dinitrotoluene	1.63 (1.32-2.13)	0.86 (0.70-1.09)	0.54 (0.43-0.73)	0.33 (0.28-0.38)	0.13
bromoform	33.2 (27.4-42.2)	33.2 (27.4-42.2)	30.5 (25.0-37.9)	29.3 (24.0-36.2)	13.0
methylene chloride	229 (204-252)	224 (198-246)	>220<280	>220<280	170
2,4-dinitrophenol	2.25	1.20	0.78	0.62	0.28

2. Daphnia magna

Compound	LC50 (95% confidence limit) mg/l		No effect concentration (mg/l)
	24-hour	48-hour	
1,4-dichlorobenzene	41.5 (17.1-98.1)	11.0 (6.57-19.1)	0.68
4-chloro-6-methylphenol	1.87 (1.46-2.30)	0.29 (0.19-0.40)	0.028
1,1,2-trichloroethane	19.4 (13.7-26.0)	18.0 (11.2-31.9)	1.0
2,3-dinitrotoluene	>2.8	0.66 (0.42-1.1)	<0.046
1-chloronaphthalene	>3.6<10	1.6 (0.97-2.6)	<0.17
1,2-dichloropropane	99.3 (57.6-605)	52.5 (42.1-68.4)	<22
1,2,4,5-tetrachlorobenzene	>530	>530	320
nitrobenzene	24.4 (19.1-30.1)	27.0 (21.8-32.5)	0.46
2,4,5-trichlorophenol	3.85 (3.15-4.72)	2.66 (2.30-3.01)	0.78
selenium	0.66 (0.53-0.87)	0.43 (0.35-0.57)	0.22
dimethylphthalate	149 (97.6-221)	33.0 (15.5-126)	<1.7

2. Daphnia magna - Continued

Compound	LC50 (95% confidence limit) mg/l		No effect concentration (mg/l)
	24-hour	48-hour	
diethylphthalate	52.1 (36.0-74.3)	52.1 (36.0-74.3)	10
acenaphthene	>280	41.2 (19.2-71.2)	0.60
methylene chloride	309 (277-341)	224 (140-326)	68
2,3,5,6-tetrachlorophenol	2.5 (1.1-5.1)	0.57 (0.28-1.3)	0.01
1,2,3,5-tetrachlorobenzene	18.1 (10.5-26.8)	9.71 (6.65-13.8)	<1.1
1,1,2,2-tetrachloroethane	15.6 (10.9-21.3)	14.1 (9.60-19.2)	4.6
4-chlorophenol	8.80 (6.91-12.5)	4.06 (3.24-5.05)	1.1
4-nitrophenol	23.7 (21.9-25.6)	21.9 (20.0-24.5)	13
bromoform	55.6 (43.9-67.6)	46.5 (42.3-51.4)	<7.8
1,3-dichloropropane	282 (202-388)	487 (356-714)	68

2. Daphnia magna - Continued

Compound	LC50 (95% confidence limit) mg/l		No effect concentration (mg/l)
	24-hour	48-hour	
2,4,6-trinitrophenol	<220	84.7 (67.0-102)	<28
1,3-dichloropropene	7.16 (5.07-10.8)	6.15 (4.33-8.99)	0.41
4-bromophenylphenylethera	<2.2	<2.2	<2.2
2,4-dinitrophenol <sup>a</sup>	>3.6	>3.6	3.6
1,1-dichloroethylene <sup>a</sup>	-	-	-
1,1-dichloropropane <sup>a</sup>	>100	>100	10
2,4-dichloro-6-methylphenol <sup>a</sup>	-	~ 0.5	0.22
carbon tetrachloride <sup>a</sup>	>10<100	>10<100	-
1,1,1,2-tetrachloroethane <sup>a</sup>	>17<46	>17<46	17
pentachlorobenzene <sup>a</sup>	>10<28	>3.6<10	1.3
butylbenzylphthalate <sup>a</sup>	>100	-	-
bis(2-ethylhexyl) phthalate <sup>a</sup>	>530	<68	<68

<sup>a</sup>In Progress

## 3. Algae

b. Freshwater species (Selenastrum capricornutum)

Compound	EC50 (95% confidence limits) ppm					No effec concentr (ppm)
	24-hour	48-hour	72-hour	96 <sup>1</sup> -hour	96 <sup>2</sup> -hour	
1,3-dichlorobenzene	138 (92.1-177)	130 (79.3-207)	124 (89.4-167)	137 (98.1-195)	114 (75.2-157)	32.0
1,4-dichlorobenzene	76.9 (43.8-115)	61.6 (17.4-114)	77.5 (43.8-146)	98.1 (65.7-136)	96.7 (64.3-134)	5.6
fluoranthene	37.7 (21.3-51.1)	32.2 (8.15-54.3)	41.4 (26.7-62.6)	54.6 (37.0-109)	54.4 (44.0-64.3)	32.0
methylene chloride	>560	>560	>560	>560	>560	56.0
antimony (antimony trioxide)	>1.0	0.74 (0.65-0.81)	0.73 (0.63-0.80)	0.74 (0.65-0.81)	0.76 (0.68-0.82)	0.2
pentachloroethane	102 (26.8-176)	70.7 (35.1-127)	87.6 (54.0-182)	72.5 (42.0-120)	80.3 (51.0-137)	10.0
dimethyl phthalate	>320	132 (64.4-260)	44.0 (28.4-71.0)	35.8 (23.2-49.5)	33.3 (20.6-45.8)	<10.0
diethyl phthalate	>560	295 (232-353)	84.1 (42.0-255)	73.3 (41.6-125)	69.5 (37.5-116)	<18.0
xromoform	63.6 (18.7-122)	46.4 (28.6-86.4)	42.0 (29.9-58.6)	38.6 (26.1-53.8)	40.1 (28.1-55.3)	10.0

3. Algae - continued

Compound	EC50 (95% confidence limits) ppm					No effe concent (ppm)
	24-hour	48-hour	72-hour	96 <sup>1</sup> -hour	96 <sup>2</sup> -hour	
diethyl phthalate	95.7 (31.6-289)	32.4 (4.81-218)	58.0 (27.4-88.4)	53.2 (18.1-157)	69.0 (46.2-97.7)	< 32.0
bromoform	>10.0	5.24 (4.14-6.27)	4.67 (2.61-10.5)	4.27 (2.05-8.93)	3.99 (1.85-8.62)	0.60
1,2-dichlorobenzene	51.8 (24.3-717)	35.0 (2.40-77.7)	35.4 (16.3-56.5)	34.3 (20.6-48.2)	34.2 (20.9-47.6)	<10.0
1,3-dichlorobenzene	42.7 (22.1-82.5)	32.1 (11.5-89.8)	47.7 (23.6-96.2)	40.4 (23.6-65.2)	38.0 (21.8-58.2)	5.6

96 = EC-50 based on in vivo chlorophyll a measurements.

96 = EC-50 based on counts of cell numbers.

Antimony trioxide insoluble in seawater at concentrations >5.0 ppm.

3. Algae

a. Saltwater species (Skeletonema costatum)

Compound	EC50 (95% confidence limits) ppm					No eff conc (ppm)
	24-hour	48-hour	72-hour	96 <sup>1</sup> -hour	96 <sup>2</sup> -hour	
1,4-dichlorobenzene	61.9 (24.9-104)	56.6 (29.0-82.9)	50.6 (38.0-73.7)	54.8 (40.7-85.8)	59.1 (32.9-85.6)	10.
fluoranthene	66.8 (38.5-97.1)	44.8 (28.9-72.0)	41.3 (27.0-62.2)	45.0 (29.4-71.5)	45.6 (30.6-70.8)	10.
1,3-dichloropropane	83.0 (59.6-104)	91.6 (71.2-111)	>32<56	>56<100	77.9 (23.6-369)	10.0
1,2,4-trichlorobenzene	9.23 (7.21-11.1)	>1.0<1.8	>1.0<1.8	5.98 (1.95-10.3)	6.10 (2.51-10.0)	<1.0
dimethyl phthalate	46.2 (14.4-521)	18.5 (9.63-27.2)	24.8 (17.2-36.6)	21.9 (13.3-32.9)	25.0 (18.6-34.2)	<10.
antimony (antimony trioxide)	>5.0 <sup>3</sup>	>5.0	>5.0	>5.0	>5.0	5.0
selenium (+4) (selenous acid)	51.7 (40.5-62.2)	15.2 (10.5-24.5)	11.3 (7.62-15.3)	13.0 (8.93-18.6)	13.5 (8.92-20.6)	<5.6
pentachloroethane	47.4 (30.1-87.6)	36.6 (21.0-54.7)	>10<32	34.8 (23.8-46.2)	34.8 (24.1-45.9)	10.0

4. Sheepshead minnow (Cyprinodon variegatus)

Compound	LC50 (95% confidence limits) ppm				No eff conc. 96-hr (ppm)
	24-hour	48-hour	72-hour	96-hour	
1,3-dichloropropane	72.2 (64.4-83.4)	72.2 (64.4-83.4)	72.2 (64.4-83.4)	72.2 (64.4-83.4)	32.0
ethylbenzene	348 (289-392)	412 (358-506)	366 (312-428)	314 (291-334)	100
bromoform	6.58 (5.57-7.83)	6.58 (5.57-7.83)	6.18 (5.14-7.25)	6.18 (5.14-7.25)	1.0
1,1,1-trichloroethane	51.1 (42.4-59.3)	53.0 (44.8-60.9)	-	53.0 (44.8-60.9)	32.0
pentachlorobenzene	>32.0	9.55 (7.00-12.4)	>3.2<10.0	0.83 (0.45-1.84)	0.3
1-chloronaphthalene	2.84 (2.26-3.72)	2.09 (1.60-2.62)	1.98 (1.50-2.48)	1.98 (1.50-2.48)	1.0
1,2,4,5-tetrachlorobenzene	>1.80	0.90 (0.69-1.25)	0.84 (0.67-1.10)	0.84 (0.67-1.10)	0.3
1,2,3,5-tetrachlorobenzene	>7.5	5.59 (5.19-5.95)	4.68 (3.89-5.51)	3.67 (3.27-4.11)	1.0
4-nitrophenol	27.7 (24.6-31.2)	27.7 (24.6-31.2)	27.1 (23.4-31.1)	27.1 (23.4-31.1)	24.0
methylene chloride	277 (246-312)	271 (234-311)	271 (234-311)	250 (211-285)	100

## 5. Sheepshead minnow - Continued

Compound	LC50 (95% confidence limits) ppm				No discernible effect level at 96-hour (ppm)
	24-hour	48-hour	72-hour	96-hour	
2,4,6-trinitrophenol	134 (105-171)	134 (105-171)	134 (105-171)	134 (105-171)	100
Butylbenzylphthalate	341 (277-387)	378 (334-414)	389 (348-422)	401 (366-432)	320
Selenium (+4 oxd.state)	91.2 (25.0-333)	41.6 (26.0-66.3)	20.8 (26.2-16.0)	11.0 (8.28-13.9)	3.2
Toluene <sup>a</sup>	>6.55	3.99 (3.62-4.33)	4.18 (3.84-4.48)	4.28 (3.97-4.58)	<0.26

<sup>a</sup>Test conducted under continuous flow conditions.

5. Mysid shrimp (Mysidopsis bahia)

Compound	LC50 (95% confidence limits) ppm				No effe concent (ppm)
	24-hour	48-hour	72-hour	96-hour	
pentachloroethane	5.35 (4.30-7.11)	3.97 (3.11-4.99)	3.03 (2.58-3.47)	3.03 (2.58-3.47)	1.8
1,2,4-trichlorobenzene	>1.0	>1.0	0.52 (0.43-0.60)	0.31 (0.19-0.45)	0.06
1,3-dichloropropane	22.9 (16.3-28.5)	26.1 (20.5-31.7)	19.7 (12.3-32.5)	8.59 (6.25-12.8)	0.6
pentachlorobenzene	0.75 (0.49-1.04)	0.72 (0.58-0.89)	0.24 (0.12-0.66)	0.16 (0.09-0.27)	< 0.06
fluoranthene	>0.32	0.10 (0.03-0.18)	0.06 (0.05-0.08)	0.04 (0.03-0.05)	0.01
ethylbenzene	161 (119-216)	130 (85.4-168)	106 (91.9-120)	100 (84.5-112)	< 50
hexachloroethane	1.48 (0.71-2.80)	0.99 (0.74-1.28)	0.99 (0.74-1.28)	0.94 (0.69-1.48)	0.1
bromoform	26.4 (16.8-46.5)	20.8 (13.0-34.7)	20.8 (13.0-34.7)	8.44 (5.85-11.3)	3.0
1,2,4,5-tetrachlorobenzene	>3.2 < 5.6	1.99 (1.24-3.29)	1.48 (0.88-2.35)	1.48 (0.88-2.35)	0.6
selenium (+4) (selenous acid)	>5.6	>5.6	3.03 (2.58-3.47)	0.98 (0.73-1.26)	0.3

**APPENDIX I**  
**Static Acute Bioassays:**  
**Raw Data and Graphical Displays**

Table 6 - continued

Compound	Species to be tested					
	Freshwater			Marine		
	Alga	Invert.	Fish	Alga	Invert.	Fish
2,4-dinitrophenol	(-)	(X)	(X)	(-)	(-)	(-)
2,4,6-trinitrophenol	(-)	(X)	(X)	(-)	(-)	(-)
2,4-dinitro-6-methyphenol	(-)	(-)	(X)	(-)	(-)	(-)
n-nitrosodiphenyl amine	-	(X)	(-)	-	-	-
Phenol	-	(-)	-	-	-	-
Butylbenzylphthalate	(-)	(X)	(X)	(-)	(-)	(-)
diethylphthalate	(X)	(X)	(X)	(X)	(-)	(X)
dimethylphthalate	(X)	(X)	(X)	(X)	(-)	(X)
Selenium (+4 oxd. state)	-	(X)	-	(X)	(X)	(-)
Tetrachloroethylene	(X)	(X)	(X)	(X)	(X)	(X)
Thallium	(X)	(X)	(X)	-	(X)	(X)
Toluene	(X)	(X)	(X)	(X)	(X)	(X)
Trichloroethylene	-	(-)	(X)	-	-	-
bis (2-ethylhexyl) phthalate		(X)				(X)